

REMARKS

This response addresses the issues raised by the Examiner in the Office Action mailed April 15, 2004. Initially, Applicants would like to thank the Examiner for the careful consideration given in this case. The Claims were 1 and 3-9. Claims 1, 3, 8 and 9 have been currently amended and Claims 11-14 have been added. Claim 4 has been canceled. Thus, Claims 1, 3, 5-9 and 11-14 are pending in this case all to more clearly and distinctly claim Applicants' invention. In view of the above amendments and the following remarks, Applicants submit that the presently pending claims are in condition for allowance and notification of such is respectfully requested.

New Claim 11 has been added to include a non-aqueous electrolytic solution which contains a high dielectric constant solvent selected from the group consisting of ethylene carbonate, propylene carbonate and butylene carbonate, and a low viscosity solvent selected from the group consisting of dimethyl carbonate, methyl ethyl carbonate, diethyl carbonate, tetrahydrofuran, 2-methyltetrahydrofuran, 1,4-dioxane, 1,2-dimethoxyethane, 1,2-diethoxyethane, 1,2-dibutoxyethane, γ -butyrolactone, acetonitrile, methyl propionate and dimethylformamide. Support for new Claim 11 appears, for example, in the specification at page 6, lines 4-12. No new matter has been added.

New Claim 12 has been added to include a non-aqueous electrolytic solution where the high dielectric constant solvent and the low viscosity solvent are contained in a ratio of 1:9 to 4:1 in terms of the ratio of former:latter. Support for new Claim 12 appears, for example, in the specification at page 6, lines 12-15. No new matter has been added.

New Claim 13 has been added to include a non-aqueous electrolytic solution which further contains vinylene carbonate or 1,3-propanesultone. Support for new Claim 13 appears, for example, in the specification at page 6, lines 16-19. No new matter has been added.

New Claim 14 has been added to include a non-aqueous electrolytic solution where the biphenyl derivative is biphenyl, o-terphenyl, m-terphenyl, or p-terphenyl. Support for new Claim 14 appears, for example, in the specification at page 5, lines 20-36. No new matter has been added.

Claim Objections

The Examiner objects to Claim 4 as being substantially the same as Claim 3. As the Examiner suggests, Applicants have canceled Claim 4 to expedite prosecution of the application. Thus, this objection is rendered moot. Withdrawal of the present objection is respectfully requested.

Rejection Based On JP'258 Under 35 U.S.C. § 103(a)

The Examiner rejects Claims 1 and 3-9 under 35 U.S.C. § 103 (a) as being unpatentable over Japanese Patent No. JP 10-321258 ("JP '258"). Applicants respectfully traverse this rejection.

The Examiner acknowledges that JP '258 does not teach providing the biphenyl in the range specified in Claims 1, 3, 4 and 9. However, the Examiner asserts that the incorporation of the biphenyl additive in the electrolyte is to improve the safety of the battery and that the tradeoff for adding the biphenyl to the electrolyte is that it reduces the capacity and cycling performance of the cell. Thus, the Examiner states that there is an obvious expectation which would have been apparent to one of ordinary skill in the art that optimizing the biphenyl additive to values below the range of JP '258 would have improved that capacity and cycling characteristics while slightly reducing the cell safety as described in JP '258. The Examiner then concludes that it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the teachings of JP '258 by reducing biphenyl additive to a lower value while still having the biphenyl additive present since it would have still provided a degree of safety to the cell while improving the cycling and capacity of the cell itself. Applicants respectfully disagree.

To establish obviousness of a claimed invention, all claim elements must be disclosed, taught or suggested by the prior art. We agree with the Examiner that JP '258 does not teach providing the biphenyl in the range specified in Claims 1, 3, 4 and 9. As stated in our previous response, U.S. Patent No. 6,074,776 ("US '776") corresponds to JP-10-321258 (JP '258). The priority data is erroneous in the patent. JP '258 teaches a method for discharging non-aqueous rechargeable lithium batteries internally after the batteries have been subjected to overcharge abuse by adding an additive, such as biphenyl. See Paragraphs [0018], [0019] and [0024]. The Examiner asserts that the incorporation of the biphenyl additive in the

electrolyte is to improve the safety of the battery and that the tradeoff for adding the biphenyl to the electrolyte is that it reduces the capacity and cycling performance of the cell. However, JP '258 does not teach or suggest that there is the stated tradeoff relationship and that the increased biphenyl additive will provide improved safety. Rather, the working examples 1, 2 and 3 of JP '258 suggests that the variation of amount of biphenyl additive (2% in Example 1, 2.5% in Example 2 and 5% in Example 3) is not essential in changing the effect of safety characteristics.

In contrast, the present invention discloses a lithium secondary battery having improved electric capacity and cycling performance and a non-aqueous electrolytic solution which is used for preparing the lithium battery. See Paragraph [0001]. Here, the inventors discovered that the addition of biphenyl additive in a very small amount of 0.001 to about 0.8 weight % is effective to improve the cycle performance particularly when the charging-discharging procedure of the lithium cell is repeated at a relatively high temperature, such as 40 °C. See Paragraphs [0007] and [0014]. In the present invention, Table 1 shows the 100 cycle retention results of Examples 1 to 10. The percentage of the 100 cycle retention dramatically decreases when the amount of biphenyl is increased to 2.5 %, as shown in Comparative Example 3.

Since JP '258 does not teach or suggest the addition of an extremely small amount (0.001-0.8 weight %) of the biphenyl additive in an electrolytic solution is effective to improve the cycle performance of a lithium secondary battery at a relatively high temperature, such as 40 °C of the cell, the Applicants believe that the present invention is not obvious over the teaching of JP '258. Therefore, Applicants respectfully request withdrawal of the rejection under 35 U.S.C. § 103 (a).

In view of the remarks presented herein, it is respectfully submitted that the present application is in condition for final allowance and notice to such effect is requested. If the Examiner believes that additional issues need to be resolved before this application can be passed to issue, the undersigned invites the Examiner to contact him at the telephone number provided below.

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